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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,299	11/19/2003	Girish Srinivas	144-02	6479
23713	7590	08/25/2004	EXAMINER	
GREENLEE WINNER AND SULLIVAN P C 5370 MANHATTAN CIRCLE SUITE 201 BOULDER, CO 80303			HERTZOG, ARDITH E	
			ART UNIT	PAPER NUMBER
			1754	

DATE MAILED: 08/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/717,299

Applicant(s)

SRINIVAS ET AL.

Examiner

Ardith E. Hertzog

Art Unit

1754

ed

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 20 May 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-53 is/are rejected.
- 7) ☒ Claim(s) 18, 19, 22-26, 30 and 38 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 November 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 5-20-2004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Priority/Effective Filing Date*

1. This application, which claims domestic priority under 35 U.S.C. § 119(e) based upon provisional application 60/427,742, filed November 19, 2002, is a continuation-in-part (CIP) of serial no. 10/358,404, filed February 3, 2003, which in turn claims domestic priority under 35 U.S.C. § 119(e) based upon provisional application 60/367,891, filed March 25, 2002; provisional application 60/388,322, filed June 13, 2002; and provisional application 60/420,694, filed October 22, 2002. A review of provisional application 60/427,742 reveals that the type(s) of catalyst effective in the instant invention—including the broadest limitations recited in applicant's independent claim 1 (i.e., that the catalyst is a "mixed metal oxide catalyst [which] comprises a low oxidation activity metal oxide and one or more higher oxidation activity metal oxides")—are disclosed via incorporation by reference of related provisional applications 60/367,891 and 60/388,322 (see p. 2, second full paragraph, in 60/427,742). Based upon MPEP 608.01(p) I. B., this incorporation by reference is **proper**, thus applicant's claim for domestic priority is **granted** (i.e., provisional application 60/427,742 provides adequate support under 35 U.S.C. § 112 for all claims of the instant application). **Accordingly, the effective filing date for all claims—claims 1-53—is November 19, 2002** (i.e., the filing date of provisional application 60/427,742), since the **simultaneous** removal of hydrogen sulfide **with mercury**, as required by **all** claims, is **new matter** with respect to parent application serial no. 10/358,404.

When applicant files a continuation-in-part whose claims are not supported by the parent application, the effective filing date is the filing date of the child CIP. Any prior art disclosing the invention or an obvious variant thereof having a critical reference date more than 1 year prior to the filing date of the child will bar the issuance of a patent under 35 U.S.C. § 102(b). *Paperless Accounting v. Bay Area Rapid Transit System*, 804 F.2d 659, 665, 231 USPQ 649, 653 (Fed. Cir. 1986). (MPEP § 2133.01)

### ***Response to Pre-Exam Informalities***

2. Receipt is hereby acknowledged of applicant's executed declaration, filed February 24, 2004, in response to the Pre-Exam Formalities Notice (Formalities Letter) mailed February 17, 2004. In addition, applicant's city of residence (for the first-named inventor), filed February 24, 2004, has been corrected.

### ***Information Disclosure Statement***

3. Receipt is acknowledged of the information disclosure statement, filed May 20, 2004. As the submission is in compliance with the provisions of 37 CFR § 1.97, the statement has been considered, in accordance with the enclosed PTO-1449 form.

### ***Abstract***

4. The abstract of the disclosure is objected to, because the heading does not read "Abstract" or "Abstract of the Disclosure" (see 37 CFR § 1.72). Appropriate correction is required.

5. Applicant is reminded of the proper language and format for an abstract of the disclosure:

The language should be clear and concise and should not repeat information given in the title. **It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.** (MPEP § 608.01(b))

6. The abstract of the disclosure is **further** objected to, because, per the bolded

citation above, it begins with, "The invention relates to". Appropriate correction is required.

### ***Drawings***

7. The drawings are objected to as failing to comply with 37 CFR § 1.84(p)(4), because reference character "415" has been used to designate **both** "the catalytic reactor (415)" (see p. 22, lines 19-20) **and** the "Direct Oxidation Reactor" (see Fig. 1 and Fig. 2). The drawings are **further** objected to as failing to comply with 37 CFR § 1.84(p)(4), because reference characters "415" and "501" have **both** been used to designate the "Direct Oxidation Reactor" (see Fig. 1 and Fig. 2) **and** "the direct oxidation reactor (501)" (see p. 23, lines 29-30; p. 24, line 8). In particular, the bracket corresponding to reference character "501" in Fig. 2 is confusing (again, this reference character described as "the direct oxidation reactor" in the specification), given that reference character "415" is **explicitly** labeled as such in **both** Figures 1 **and** 2.

8. The drawings are objected to as failing to comply with 37 CFR § 1.84(p)(5), because they include the following reference characters **not** mentioned in the description: 807 in Figure 5 (see corresponding description at pp. 26-27 of the specification); 911 in Figure 6 (see corresponding description at pp. 27-28 of the specification) **and** 1007 in Figure 7 (see corresponding description at p. 28 of the specification).

9. **Note that *all other* aspects of the drawings are accepted, in accordance with the enclosed PTO-948.**

10. **Corrected drawing sheets, with amendment to the specification as/if**

necessary, are required in reply to this Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended". If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR § 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. Any objection to the drawings will not be held in abeyance.

***Minor Informalities – Disclosure/Specification***

11. The disclosure is objected to, because of the following minor informalities:
  - a. On page 1, the "Cross-Reference to Related Applications" paragraph should be revised as follows: "This application, which claims the benefit of U.S. Provisional Application 60/427,742, filed November 19, 2002, is a continuation-in-part of US application serial no. 10/358,404, filed February 3, 2003, which in turn claims the benefit of U.S. Provisional Application 60/367,891, filed March 25,

2002; U.S. Provisional Application 60/388,322, filed June 13, 2002; and U.S. Provisional Application 60/420,694, filed October 22, 2002" (see MPEP § 201.11 III. B.).

- b. At page 16, line 6 is not understood—i.e., "comprise about 0.4% to about 6% by weight of and about 0.4% to about 6% by weight of".
- c. On page 32, at lines 10-11, the specific oxidation catalyst "TDA#2" apparently lacks antecedent basis in the specification.
- d. In Figure 3, it is suggested that "Inventive" be inserted before "H<sub>2</sub>S Oxidation and Hg Removal Process" in reference character 601, for consistency with the rest of the Figures (specifically Fig.'s 4-7).
- f. In claim 1, at page 35, line 6, it is suggested that "step " be revised as "steps", for clarity.
- g. In claim 12, at page 36, line 16, "sufur-containing" should be "sulfur-containing".
- h. In claim 16, "claims" should be "claim".

Appropriate correction of all the above is required.

### ***Specification***

12. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR § 1.75(d)(1) and MPEP § 608.01(o). Clear antecedent basis for the following claim limitations has not been found in the specification:

- a. the **alpha** and **gamma** alumina recited in claim 17;

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- b. the “85% by weight” lower limit recited in claim 29 (see paragraph bridging pp. 14-15);
- c. the **combination of the specific** weight percentage ranges of oxides recited in **each** of claims 31-34 (see full paragraph on p. 14 – last full paragraph on p. 16);
- d. the catalyst binder limitations of **both** claims 36 **and** 37;
- e. the **specific** surface area range recited in claim 41; and
- f. the catalyst preparation limitations recited in **both** claims 43 **and** 44.

Clarification and/or appropriate correction of all the above is required.

13. The attempt to incorporate subject matter into this application by reference in the “Cross-Reference to Related Applications” paragraph at page 1 of the specification is considered improper, because subject matter, whether essential or non-essential, may not be **partially** incorporated by reference. See MPEP § 608.01(p) I. for guidelines re proper incorporation by reference. In particular, the language used by applicant in the last sentence of this paragraph appears confusing on its face, i.e., “incorporated by reference herein **in its entirety to the extent that it is not inconsistent with the disclosure herein**” (emphasis added). That is, it is respectfully submitted that one of ordinary skill would not be able to **readily** ascertain whether or not the parent applications, **whether in whole or in part**, would or would not be considered by applicant as “inconsistent with the disclosure herein”, **especially** since applicant **also** states that each applications “is incorporated by reference herein **in its entirety**” (emphasis added). It is therefore suggested that the end of this sentence (i.e., “to the



extent that it is not inconsistent with the disclosure herein") be deleted. Appropriate correction is required.

14. **In addition**, the attempt to incorporate subject matter into this application by reference in the last sentence of the specification is considered improper, because subject matter, whether essential or non-essential, may not be **partially** incorporated by reference. See again MPEP § 608.01(p) I. for guidelines re proper incorporation by reference. In particular, the language used by applicant in this sentence appears confusing on its face, i.e., "incorporated by reference herein **to the extent that they are not inconsistent with the disclosure herein**" (emphasis added). That is, it is respectfully submitted that one of ordinary skill would not be able to **readily** ascertain whether or not a particular reference cited in the specification, **whether in whole or in part**, would or would not be considered by applicant as "inconsistent with the disclosure herein". It is therefore suggested that the end of this sentence (i.e., "to the extent that they are not inconsistent with the disclosure herein") be deleted (alternatively, the entire sentence could be deleted). Appropriate correction is required.

#### ***Claim Objections***

15. Claims 18, 19, 22-26, 30 and 38 are objected to, because each contains improper Markush group language and/or alternative language; see MPEP § 2173.05(h) I. Specifically:

- a. In claim 18, at line 1, "the group consisting of" should be inserted after "selected from" **and**, at line 2, before "mixtures", "or" should be replaced with "and".

- b. **Further** in claim 18, at line 3, before "an oxide of a metal", it is suggested that "selected from" be **deleted** (as it is not understood how this phraseology further limits the recited higher activity metal oxides).
- c. **Still further** in claim 18, at line 3, before "V", "the group consisting of" should be inserted after "selected from".
- d. In claim 19, at lines 1-2, it is suggested that "selected from" be **deleted** (as it is not understood how this phraseology further limits the recited higher activity metal oxides).
- e. **Further** in claim 19, at line 3, "or" should be replaced with "and".
- f. In **each** of claims 22, 23, 24 **and** 25, at line 3, "the group consisting of" should be inserted after "selected from".
- g. In claim 26, at line 2, before "Cu", "and" should be replaced with "or".
- h. In claim 30, at line 3, "the group consisting of" should be inserted after "selected from".
- i. In claim 38, at line 2, "the group consisting of" should be inserted after "selected from".

Appropriate correction of all the above is required.

***Claim Rejections - 35 U.S.C. § 112***

16. The following is a quotation of the first paragraph of 35 U.S.C. § 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

17. Claims 1, 3-13, 30, 31, 36, 37 and 39-53 are rejected under 35 U.S.C. § 112, first

paragraph, as based on a disclosure which is not enabling. That the "low oxidation activity metal oxide" is "titania, zirconia, silica, alumina or mixtures thereof" (see p. 13, lines 27-29) is evidently critical or essential to the practice of the invention but not included in claims 1, 3-13, 30, 31, 36, 37 and 39-53; thus, it is respectfully submitted that these claims are not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Again, the specification appears to teach that the "low oxidation activity metal oxide" **must** be a specific compound (see again p. 13, lines 27-29), rather than **any** "low oxidation activity metal oxide", as presently recited in claims 1, 3-13, 30, 31, 36, 37 and 39-53. **Accordingly**, it is respectfully submitted that these claims should be so limited; incorporating a Markush group of suitable low oxidation activity metal oxides into the independent claim 1 would be one means of overcoming this rejection (for example, inserting "selected from the group consisting of titania, zirconia, silica, alumina and mixtures thereof" after "low oxidation activity metal oxide" in claim 1). Appropriate correction is required.

***Claim Rejections - 35 U.S.C. § 103***

18. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

19. Claims 1-3 and 5-52 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Srinivas et al. (US 6,099,819) in view of Audeh (US 4,786,483).

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Srinivas et al. **exemplify** methods for treating hydrogen sulfide-containing gas streams, which, **with the exception of the simultaneous removal of mercury with hydrogen sulfide**, meet all material limitations of applicant's claims 2, 9-15, 18-22, 28-30, 36-41, 43, 44 and 46 as follows: In Figures 4, 5 and 7-12: a

gas stream containing hydrogen sulfide or other sulfur-containing compounds... [is contacted] with a mixed metal oxide catalyst at a temperature equal to or less than about 400°C in the presence of oxygen such that a substantial amount of the hydrogen sulfide or other sulfur-containing compounds present in the gas stream is oxidized to sulfur; and... wherein the mixed metal oxide catalyst comprises a low oxidation activity metal oxide and one or more higher oxidation activity metal oxides [(i.e., as recited in **instant independent claim 1**)];

wherein the "low oxidation activity metal oxide" comprises titania (per **instant claims 2, 14, 15, 18, 19, 22 and 38**, in amounts within the scope of **instant claims 28 and 29**), and the "higher oxidation activity metal oxide" comprises one of the following: niobium, vanadium, iron, copper or cerium oxide (per **instant claims 18-22, 30 and 38**, in amounts within the scope of **instant claim 30**). Note that these exemplary catalysts (corresponding to Fig.'s 4, 5 and 7-12) contain no silica binder (per **instant claims 36 and 37**, given that "the term 'up to' includes zero as a lower limit, *In re Mochel*, 470 F.2d 638, 176 USPQ 194 (CCPA 1974)" (see MPEP § 2173.05(c) II.). Note that **in addition to** meeting the temperature requirements of instant claim 1, the temperatures discussed in conjunction with Figures 4, 5 and 9-12 fall within the scope of one or more of the corresponding ranges recited in **instant claims 9-11**. Note that **in addition to** meeting the "substantial amount of the hydrogen sulfide or other sulfur-containing compounds present in the gas stream is oxidized to sulfur" limitations of instant claim 1, the resultant gas streams in these examples (corresponding to Fig.'s 4, 5 and 7-12) evidently **also**

meet the conversion requirements of **instant claim 12** (see especially Fig. 5, as well as related Fig. 6), **and** clearly meet the “substantially... sulfur” requirement of **instant claim 13**. Based on Srinivas et al. Examples 1 and 2, these exemplary catalysts (again, corresponding to Fig.’s 4, 5 and 7-12) meet all manufacturing requirements recited in **instant claims 39, 40, 43 and 44**, while, based on Srinivas et al. Figure 3, they **also** meet the surface area requirements of **instant claim 41**. **Further** note that as Srinivas et al. **exemplify** methods which, **with the exception of the simultaneous removal of mercury with hydrogen sulfide**, fall within the scope of applicant’s independent claim 1, they **must also exemplify** methods falling within the scope of **instant claim 46** (dependent upon instant claim 1), given that step c. as recited therein is **optional**. **Moreover**, Srinivas et al. generally teach that “[t]he catalysts of this invention function in the presence of potentially interfering substances, such as carbon dioxide, water, and hydrocarbons, including methane, benzene, toluene, xylene, among others” (see col. 5, lines 27-30). **Therefore**, it would have been obvious to one of ordinary skill in the art, at the time of applicant’s invention, to have utilized the Srinivas et al. catalysts to selectively oxidize hydrogen sulfide in the presence of any of these “potentially interfering substances”, per **instant claims 3, 5, 6 and 8**, because, as just discussed, such use is **clearly** within the scope of the broad teachings of this patent (noting that “hydrocarbons, including methane, benzene, toluene, xylene, among others” read on the “hydrocarbons” of these claims of applicant (see also Srinivas et al. claim 19)). Srinivas et al. **further** generally teach that “[t]he mixed metal oxide catalysts of this invention can also be prepared as supported catalysts. Preferred support materials are

$\alpha$ -alumina and silica materials" (see col. 5, lines 16-18). **Therefore**, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to have prepared the Srinivas et al. catalysts with  $\alpha$ -alumina (supports), per **instant claims 16 and 17**, because, as just discussed, such catalysts are **clearly** within the scope of the broad teachings of Srinivas et al. (see also Srinivas et al. Example 2). **In addition**, Srinivas et al. generally teach that:

The catalytically active component of the catalyst comprises a mixture of metal oxides containing titanium oxide **and one or more** metal oxides. The other metal oxides can be selected from the group of metal oxides or **mixtures of** metal oxides of transition metals or lanthanide metals. ... Preferred metal oxides for combination with TiO<sub>2</sub> in the catalysts of this invention include oxides of V, **Cr, Mn, Fe, Co, Ni, Cu, Nb, Mo**,...

**More preferred** catalysts of this invention are homogenous mixtures of titanium oxide **and one or more** oxides selected from the group of metal oxides of **Nb, V, Cr, Mn, Fe, Co, Ni, Cu, Mo**, and W. ...

The mixture of metal-titanium oxides of the catalysts of this invention preferably contains **30 mole % or less of the second metal oxide or mixture of metal oxides**. **More preferably** the catalyst contains **10 mole % or less of the second metal oxide or mixture of metal oxides**. ...

Catalysts of this invention have improved activity and/or selectivity for elemental sulfur production. Further improvements of activity and/or selectivity can be obtained by introducing relatively low amounts (**up to about 5 mol %**) of a **promoter metal oxide (preferably of metals other than titanium and that of the selected second metal oxide)**...

Promoters can be selected from transition and lanthanide metals including V, **Cr, Mn, Fe, Co, Ni, Cu, Nb, Mo**,... Preferred promoters are transition metals/metal ions and more preferred are the metals/metal ions of V, **Cr, Mn, Fe, Co, Ni, Cu, Mo**, and W. (col. 3, line 58 – col. 4, line 59, emphasis added)

**Therefore**, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to have utilized mixtures of **any** of the above metal oxides in the Srinivas et al. catalysts, per **instant claims 23-27 and 31-35**, because, as just discussed, such mixtures, in appropriate relative proportions thereof, are **clearly** within

the scope of the broad teachings of this patent. Srinivas et al. **also** generally teach that “[u]nder reaction conditions, some or all of the oxides in the catalyst of this invention may be converted to the corresponding metal sulfides or sulfates, which are also active for the selective oxidation reaction” (see col. 4, lines 60-63). **Therefore**, catalysts meeting the “sulfated on contact” requirements of **instant claim 42** would have been obvious to one of ordinary skill in the art, at the time of applicant’s invention, because, as just discussed, such catalyst limitations are **clearly** within the scope of the broad teachings of this patent. Srinivas et al. **further** generally conclude that:

The selective oxidation catalysts of this invention can be used or readily adapted for use in a variety of applications. For example, they can be employed in Claus tail-gas treatment processes, for sulfur recovery from refineries, off-shore platforms, coal gasifiers and for treatment of vent gases from water treatment plants. The catalysts are particularly useful for sulfur recovery from small-scale sour gas processing plants. (col. 15, lines 39-46)

**Therefore**, it would be obvious to one of ordinary skill in the art, at the time of applicant’s invention, to have “readily adapted” any of the Srinivas et al. catalysts “for use in a variety of [H<sub>2</sub>S removal] applications”, because, as just discussed, such end uses are **clearly** within the scope of the broad teachings of Srinivas et al. When having done so, it is respectfully submitted that, absent contrary evidence, methods falling within the scope of **instant claims 45 and 47-52** would have obviously resulted (noting that Srinivas et al. at least generally teach the treatment of natural gas streams, per **instant claim 52** (as well as **instant claim 7**) (see, for example, col. 1, lines 21-27)); **furthermore**, applicant apparently admits in the instant specification that the supplementary H<sub>2</sub>S removal processes recited in **instant claims 45 and 47-51** are

known in the prior art<sup>1</sup> (see, for example, instant p. 7, lines 4-17, and instant p. 8, line 15 – instant p. 10, line 3). **Accordingly**, Srinivas et al. teach or would have rendered *prima facie* obvious all material limitations of applicant's claims 1-3 and 5-52, **except for, again, the simultaneous removal of mercury with hydrogen sulfide. However**, it is again noted that Srinivas et al. **at least generally teach the treatment of natural gas streams** (see again, for example, col. 1, lines 21-27).

20. In the "Prior Art" section of the Audeh patent (which is itself directed towards processes for removing hydrogen sulfide and mercury from gases—specifically, "an improved process for removing in a single step both hydrogen sulfide and trace quantities of mercury present in a gas, particularly a natural gas" (see col. 1, lines 41-44)), it is stated:

Gas produced from some natural gas filed [sic] contains hydrogen sulfide and small amounts of mercury. Both hydrogen sulfide and mercury are undesirable components of the gas and must be removed. Ordinarily hydrogen sulfide is recovered by contacting the gas with an absorptive liquid such as an industrial amine and subsequently heating the liquid and stripping it to recover the amine for reuse. Mercury is removed separately by another process...

The processing of natural gas in LNG plants requires contact of mercury-laden natural gas with equipment made primarily of aluminum. This is particularly true after the processing steps of treating the gas to remove carbon dioxide and hydrogen sulfide when the gas is chilled or cooled in aluminum-constructed the exchangers. Aluminum heat exchangers represent a capital investment of several million dollars. Damage to these exchangers is to be avoided if at all possible. Although the concentration of mercury in natural gas appears low, the effect of mercury is cumulative as it amalgamates with the aluminum. The result can be damage to the system, particularly the heat exchangers, such as corrosion cracking leading to equipment failure. Repair is correspondingly difficult because of damage to the welded seams of the aluminum.

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<sup>1</sup> "When applicant states that something is prior art, it is taken as being available as prior art against the claims. Admitted prior art can be used in obviousness rejections. *In re Nomiya*, 509 F.2d 566, 184 USPQ 607, 611 (CCPA 1975)" (see MPEP § 2129)



Replacement of the heat exchangers in an LNG plant represents a large expenditure. (col. 1, lines 10-40)

**Therefore**, when having utilized the Srinivas et al. mixed metal oxide catalysts to remove hydrogen sulfide from natural gas streams—again, as at least generally taught by Srinivas et al.—it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to have **also** removed any mercury present therein **at the same time**, because, as just discussed, Audeh establishes that not only was it known in the art that natural gas streams contained **both** hydrogen sulfide **and** mercury, but **also** that it was desirable to remove both in a single step. When having done so, it is respectfully submitted that, absent contrary evidence, methods falling within the scope of applicant's claims 1-3 and 5-52 would have obviously resulted (noting that **at least some** mercuric sulfide may be reasonably considered to have formed, per step b. of applicant's independent claim 1, given the resultant presence of **both** sulfur **and** mercury reactants).

21. Claims 4 and 53 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Srinivas et al. in view of Audeh, as set forth above, and **further** in view of Hass et al. (US 4,088,743). Srinivas et al. and are relied upon as set forth in paragraphs 19.-20. above, having rendered *prima facie* obvious applicant's independent claim 1, as well as instant claims 46 and 47 (upon which instant claims 4 and 53 ultimately depend). Srinivas et al. and Audeh fail, however, to disclose that the H<sub>2</sub>S-containing reactant gas streams may contain hydrogen and/or carbon monoxide, i.e., as **explicitly** recited in instant claim 4 and as **implicitly** recited in instant claim 53 (i.e., which requires treatment of "a synthesis gas stream" (which is "a mixture of carbon monoxide and

hydrogen", as established by the Satterfield reference (p. 419) cited by applicant (on p.4 of the PTO-1449))).

22. Hass et al. teach catalytic incineration of hydrogen sulfide from gas streams, wherein "[h]ydrogen, carbon monoxide and light hydrocarbons present in the feed gas are not oxidized" (see abstract). More specifically, the "sour" gas streams to be treated contain:

at least about 50, usually at least about 100 ppmv of H<sub>2</sub>S, and at least about 100, **usually at least about 500 ppmv**, of at least one oxidizable component selected from the class consisting of **hydrogen, carbon monoxide** and light hydrocarbons. (col. 2, lines 53-58, emphasis added)

**Therefore**, it would have been **further** obvious to one of ordinary skill in the art, at the time of applicant's invention, that, when having modified the Srinivas et al. catalytic processes in view of Audeh as set forth *supra*, such processes could **also** be used for treating H<sub>2</sub>S-containing reactant gas streams which **further** contain hydrogen and/or carbon monoxide, because, as just discussed, Hass et al. establish that the catalytic treatment of gas streams containing not only H<sub>2</sub>S, but **also** hydrogen and/or carbon monoxide was known in the art. When having done so, it is respectfully submitted that, absent contrary evidence, methods falling within the scope of **instant claims 4 and 53** would have obviously resulted.

### **Conclusion**

23. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. These references are considered cumulative to or less material than those discussed above and include those cited in parent application serial no. 10/358,404 (that is, the majority of patents cited on the enclosed PTO-892 have been


cited in the parent application but are not cited on the enclosed PTO-1449), while Yamada et al. (US 4,206,183) and Audeh et al. (US 4,981,577 and 4,983,277) are directed towards mercury removal from gas streams. Note that the applied Srinivas et al. patent was cited during prosecution of the Keller et al. patent (US 6,759,510 B2). Note that the Wheelock et al. (US 4,002,720) and Bouyanov et al. (US 5,512,258) patents were cited during prosecution of the Srinivas et al. patent

24. Any inquiry concerning this communication should be directed to Ardith E. Hertzog at telephone number (571) 272-1347. The examiner can normally be reached on Monday through Friday (from about 7:30 a.m. - 3:30 p.m., Eastern Time).

25. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman, can be reached at (571) 272-1358. The fax phone number for the organization where this application is assigned is 703-872-9306.

26. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. For any questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
AEH  
August 18, 2004

  
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